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Title: Is the perioperative period no longer a problem for adult asthmatics under control?-OPERA study

Running head: Asthma, preoperative risk assessment

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ABSTRACT

BACKGROUND: Asthma is a global health problem and a chronic condition that persists through a patients's entire life, during which the possibility of a surgical procedure is common. An accurate clinical and functional evaluation of respiratory functions and asthma control are needed in patients undergoing surgical procedures and requiring general anesthesia.

OBJECTIVE: The aim of this study was to disclose any possible relation between postoperative complications and some pre and postoperative factors including clinical complaints and findings, asthma control test (ACT), pulmonary functions, oxygen saturation, the location of surgery and the type of anesthesia.

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METHOD: In this prospective cross-sectional study, randomly selected 111 asthmatic patients that presented to 10 different tertiary centers were included in the study. The patients were evaluated at three different period; any day between 1-7 days before surgery, postoperative third and seven-tenth days.

RESULTS: Among the patients included in the study, 77.5% were women and mean age was 52.2±13.8 years. General anesthesia was the most common anesthesia type (89.2%) and 33.3% of patients have had thoraco-abdominal surgery. There was statistically significant difference betwwen in preoperative and postoperative 3rd day values including ACT scores (22.2±3.16 and 21.59±3.84, respectively, p<0.001) ; FEV1% (84.92±19.12 and 78.26±18.47, 83,respectively p<0.001) ; PEF% (79.51±21.12 and 70.01±19.72, respectively p<0.001) and oxygen saturation (96.95±1.82 and 95.8±3.32, respectively p<0.001). Bronchospasm and pain were the most common complications during the postoperative period.

CONCLUSION: Controlled asthma under treatment step 1-2-3 does not cause any serious postoperative pulmonary complications. So, to achieve To achieve optimal control level of asthma at the preoperative period must be considered as 'gold standard' to reduce the risk of postoperative pulmonary complications in asthmatic patients.

Key words: asthma, preoperative evaluation, pulmonary risk, postoperative complications.

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INTRODUCTION

Asthma effects patients of all ages and persists through a patients' entire life, during which the possibility of a surgical procedure is common (1). The prevalence of postoperative pulmonary complications (PPCs) in non-cardiothoracic surgeries was reported to be 2 to 19%, in cardiothoracic surgery incidence range 8 to 39% (2,3). It is clinically very important to reduce PPCs in asthmatic patients and proper perioperative management strategies is necessary to predict PPC risk in asthma patients. There are two types of risk factors for PPCs. One is patient-related risk factors, such as aging and pulmonary function and the other is procedure-related risk factors such as anesthetic techniques and operating time (4) Most common PPCs include atelectasis, pneumonia, bronchitis, bronchospasm, hypoxemia, respiratory failure and prolonged mechanical ventilation (5)

Because of airway hyperreactivity, bronchospasm may be precipitated by instrumentation, a variety of drugs, and perioperative complications such as aspiration, infection, or trauma in asthmatic patients [6]. The type of anesthesia has not been demonstrated to be a risk factor for postoperative pulmonary complications in asthmatics [5].

An accurate clinical and functional evaluation of respiratory functions and asthma control are needed in patients undergoing surgical procedures and requiring general anesthesia. In GINA

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guideline, for elective surgery, achieving good asthma control is recommended for patients with more severe asthma, uncontrolled symptoms,exacerbation history, or fixed airflow limitation.

Asthmatic patients are routinely evaluated by chest medicine specialist at preoperative period. However, preoperative risk factors is less well known in asthmatic patients with proper preoperative evaluation. The aim of this study was to disclose any possible relation between peri- or postoperative complications and some preoperative factors including clinical complaints and findings, asthma control test (ACT), pulmonary functions, oxygen saturation, the location of surgery and the type of anesthesia.

MATERIALS AND METHOD

This prospective crossectional study included 111 adult asthma patients that presented to 10 different adult chest diseases departments for preoperative consultation between January-December 2012. Patients were evaluated preoperatively, postoperative 3rd and 7-10th day. Demographic data, type of operation, type of anesthesia, site of operation, type of anesthesic agents, all kinds of other medications, comorbid diseases, symptom scores as visual analog scale of cough, sputum, dyspnea, wheezing, dyspnea on exertion and nocturnal asthma, pulmonary function tests (FEV1 %,PEF %), oxygen saturation(SaO2) and asthma control test scores(ACT) at stated days, postoperative complications, preoperative bronchodilator usage status, difficulty on intubation, postoperative narcotic analgesic usage were recorded using a questionnaire administered by a trained physician.

Patients who volunteered for the study were included in the study, those who did not want to participate in the study were excluded.

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The study protocol was approved by the local Ethics Committee. Verbal voluntary informed consent was received from patients.

Statistical analysis

Statistical analysis was performed using SPSS v.18.0 for Windows. The usual statistical tests were performed for univariate analysis. Chi-square test for categorical variables and t-test for continuous variables were used. The level of statistical significance was set at $P < 0.05$.

RESULTS

Among the patients included in the study, 77.5% were women and mean age was 52.2±13.8 years (Table 1).Among patients, 80.2% of patients were non-smoker but 6.3% of patients were current smoker. As medications, 11.7% of patients were receiving step 1-2 treatment (low dose inhaled corticosteroids, only montelucast or short acting β-agonist), 36.9% of patients were receiving step 3 treatment, %31.4 of patients were receiving step 4-5 treatment.

General anesthesia was the most common anesthesia type (89.2%) and only 4.5% of the operations were emergent. Only 7.2% of the operations were laparoscopic. 33.3% of patients have had thoraco-abdominal surgery and 18.9% of patients have had nasal polyposis operation (Table 2).

ACT scores, FEV1, PEF and oxygen saturation values were statistically significantly lower on the 3rd day visit, but returned to normal on 7-10th day (preoperatively, on 3rd and 7-10th days respectively: ACT: 22.2±3.16, 21.59±3.84, 22.28±3.2, p<0.001; FEV1 (per cent of the predicted): 84.92±19.12, 78.26±18.47, 83.94±19.31, p<0.001; PEF (per cent of the predicted): 79.51±21.12, 70.01±19.72, 76.95±19.69, p<0.001; SaO2: 96.95±1.82, 95.8±3.32, 96.97±2.08, p<0.001)(Table 3). There were no

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statistically significant differences between symptom scores of the mentioned days at thoracoabdominal surgery patients (Table 4).

Fever, pain, immobilization, abdominal distension and bronchospasm were recorded as postoperative complications. Bronchospasm and pain were statistically significantly more common on the 3rd day visit than 7-10th day visits (respectively $p=0.002$, $p\leq0.001$). Among the 12 bronchospasm patients only 3 have had thoracoabdominal surgery. Narcotic analgesic usage was statistically significantly higher on 3rd day ($p\leq0.001$) but there was no relation with complications (Table 5).

DISCUSSION

In the present study, there was not any possible relation between peri- or postoperative complications and some preoperative factors (clinical complaints and findings, asthma control test (ACT), pulmonary functions, oxygen saturation, the location of surgery and the type of anesthesia) in adult asthmatic patients.

Postoperative pulmonary complications (PPC) are a significant source of mortality and morbidity. Practically and ethically, it is impossible to determine dominant contribution from surgery or from anesthesia. Bronchospasm is one of most significant respiratory event during anesthesia [8]. The risk of bronchospasm in the perioperative period is low in stable asthmatic patients and when it occurs is usually not associated with serious morbidity. The occurrence of potentially life-threating bronchospasm in anesthesia practice varies from 0.17 to 4.2% [9]. In this study, bronchospasm prevalence was 11.2% on 3rd day and 1.9% on 7-10th day which does not cause any serious problem.

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Definition of bronchospasm was made clinically, there was no objective test for this, because of that our broncospasm rates may be high.

PPCs occur commonly in patients who undergo anesthesia and upper abdominal or thoracic surgery [10]. Risk factors for PPCs in asthmatics include recent asthma symptoms, recent use of anti-asthma drugs or therapy in hospital, and history of tracheal entubation for asthma [6].

Patients who undergo abdominal (upper and lower) and thoracic surgery have a decreased postoperative vital capacity and functional residual capacity (FRC). This decrease in FRC results in ventilation-perfusion mismatch and contributes to the development of hypoxemia. Laparoscopic surgery might have advantages in patients with underlying lung disease. There is improved FEV1 and FVC, better arterial oxygenation, and improved ventilation after laparoscopic as compared with open procedures [11]. But, upper abdominal laparoscopic surgery is associated with dysfunction of the diaphragm. The site of surgery rather than the surgical technique is critical in determining whether there will be diaphragmatic dysfunction. In this study, thoracoabdominal surgery constituted 33.3% of all operations. And only 3 of 12 bronchospasm patients have had thoracoabdominal surgery.

Laboratory testing can predict patients at risk for PPCs but tests have not been shown to have superior sensitivity or specificity compared with clinical observations. Spirometry does not allow calibration of a patient's risk, but may enhance diagnosis of lung disease. Baseline arterial blood gases do not improve risk assessment. In the present study, FEV1 %, PEF % and oxygen saturation had decreased statistically significantly on 3rd day but this decline was not consistent with clinical symptoms. Mean FEV1 ratios of the study patients were 85%, so the low complications rate also could be related with better spirometric values of these patients. Only 31.4% of patients were using

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step 4-5 asthma treatment, most of our study population was controlled asthma patients under treatment step 1-2-3so complication ratios were low.

The type of anesthesia has not been demonstrated to be a risk factor for PPCs in asthmatic patients. In Warner et al study including 1500 patients with asthma, the complication rates for general and regional anesthesia were similar, but regional anesthesia was safer for asthmatic patients to avoid instrumentation of the airway. Since general anesthesia frequency was very high (89.2%) in present study, it was not possible to make a comparison between the two groups.

It is recommended to avoid drugs that cause histamine release in patients with asthma. Although many narcotic analgesics are notorious in this regard, they have never been shown to have deleterious effects in asthmatic patients. In fact, they may be desirable because of their depressant effects on airway reflexes and coughing [12]. In present study, narcotic analgesic usage was statistically significantly higher on 3rd day ($p \leq 0.001$) but there was no relation with complications.

There are some limitations of this study. Firstly, all of the centers in this study are tertiary health care centers so most of asthmatic patients were controlled asthma patients under treatment step 1-2-3' (patient bias). We could not compared thsese asthma patients and step 4-5 severe asthma patients. Secondly, when we separate patients according to operation site and complications, number of patients were too low to make comparison. Thirdly, in different studies, operation time longer than 2 hours and 5 hours was risk factor of PPCs [13-14]. In this study, operation time was not recorded. We didn't calculate sample size and power of the study and these are also limitations of our study.

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The first thing to do in the preoperative evaluation is to assess whether the patient's asthma is under control or not [15]. Optimally controlled asthmatics could undergo general anesthesia with lower risks especially in emergency conditions when it is not possible to peform any preoperative evaluation [16].

As a result, controlled asthma patients under treatment step 1-2-3 asthma is not a serious risk factor for pulmonary complications. It is not necessary to perform pulmonary function test or arterial blood gas analysis in an asymptomatic patient with controlled asthma. Optimal treatment should be arranged to keep FEV1 or peak flow rate (PEF) over 80% in asthmatic patients who undergo elective surgery. Further studies are needed to compare risk factors in mild-moderate asthma and severe asthma patients.

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Table 1. Demographic characteristics of patients

	n=111 %(n)
Female/male	77.5 (86)/22.5 (25)
Age (yrs)(range)	52.2±13.8 (20-87)
Smoking	
Nonsmoker	80.2 (89)
Exsmoker	10.8 (12)
current smoker	6.3 (7)
Body mass index(kg/m²)	29.3±5.8 (20-44.8)
Asthma treatment (n=89)	
ICS	6.3 (7)

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ICS+LABA	34.2 (38)
ICS+MONT	2.7 (3)
ICS+LABA+MONT	30.6 (34)
Oral CS	0.9 (1)
SABA as needed	3.6 (4)
Only MONT	1.8 (2)

18. ICS:inhaled corticosteroid , LABA:long acting β² agonist, MONT: montelukast, CS:corticosteroid, SABA:short acting β² agonist

Table 2. Characteristics of operations

	% (n)
Operation type	
Emergency	4.5 (5)
Laparoscopic	7.2 (8)
Type of anesthesia	
Local-spinal	10.8 (12)
General	89.2 (99)

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Site of operation	
Thorax	3.6 (4)
Upper abdomen	9.9 (11)
Lower abdomen	19.8 (22)
Cranial	5.4 (6)
Orthopedic	18.9 (21)
Nasal polyposis	18.9 (21)
Others	23.4 (26)

Table 3. Symptom scores of all patients*

	Preoperative (n=111)	**3rd day (n=73)**	**7-10th day (n=96)**	**P**
Cough	1.24±1.96	1.7±1.99	1.2±1.55	<0.001
Sputum	0.74±1.54	0.77±1.29	0.62±1.25	0.037
Wheezing	0.77±1.68	0.99±1.61	0.67±1.29	0.001
Dyspnea on exertion	2.55±2.47	2.48±2.5	2.19±2.23	0.001

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Nocturnal asthma	0.41±1.19	0.51±1.14	0.35±1.08	0.031
FEV1	84.92±19.12	78.26±18.47	83.94±19.31	<0,001
PEF	79.51±21.12	70.01±19.72	76.95±19.69	<0,001
Saturation	96.95±1.82	95.8±3.32	96.97±2.08	<0,001
ACT	22.2±3.16	21.59±3.84	22.28±3.2	<0,001

*mean±SD ACT: asthma control test

Table 4. Symptom scores of thoracoabdominal surgery patients

	Preoperative (n=111)	**3rd day (n=73)**	**7-10th day (n=96)**	**P**
Cough	0.95±1.58	1.74±2.15	1±1.16	0,006
Sputum	0.76±1.59	0.74±1.16	0.53±1	0.073
Wheezing	0.59±1.26	0.88±1.53	0.61±1.15	0.099
Dispnea on exertion	2.57±2.3	2.88±2.45	2.39±2.26	0.037
Nocturnal	0.3±1.22	0.26±0.71	0.31±1.06	0.331

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asthma				
FEV1	80.97±19.81	71.44±17.31	78.65±22.54	0.081
PEF	75.91±21.33	66.89±17.18	73.71±22.08	0.007
Saturation	96.85±1.52	95.93±2	96.84±1.95	0.007
ACT	22.46±3.02	21.31±4.18	22.15±3.31	<0.001

Table 5. Postoperative complications

	3rd day (n=107)(%)	**7-10th day (n=108)(%)**	**P**
Fever	13 (11.7)	-	-
Pain	28 (26.2)	11 (10.2)	<0.001
Immobilization	2 (1.8)	-	-
Distension	4 (3.7)	1 (0.9)	0.375
Bronchospasm	12 (11.2)	2(1.9)	0.002
Narcotic analgesic usage	38 (34.5)	3(2.8)	<0.001

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